Revision of the Seasonally Adjusted Index of New Passenger Automobile Sales

THE Bureau of Foreign and Domestic Commerce has revised its seasonally adjusted index of the dollar value of new passenger automobile sales. A description of the methods and techniques employed in revising the seasonal factors so that they would adjust both for the effect of the varying date of new model introduction and for variations of the usual seasonal character is herewith presented together with a table showing the unadjusted and adjusted index figures for the years 1928–41.[1]

The index represents monthly consumer outlay on new passenger automobiles relative to the base period, 1935–39. It is based on the actual number of new cars sold by dealers each month converted to a dollar basis by the application of an estimated average price per car.[2] The sources of the basic data and methods used in computing the unadjusted index are given in the April 1934 issue of the Survey of Current Business.

The revision of the seasonally adjusted index has been made primarily to allow for the effect of the change in the date of new model introduction, which has drastically altered the seasonal pattern. Formerly, new models were introduced around the beginning of the year, but since 1935 models have been announced in the fall.

A change in methodology also has become necessary. Prior to 1935, sales of passenger cars followed a fairly regular seasonal pattern, and constant seasonal adjustment factors were used. Since that date, new models have been introduced as early as September, as was the case in 1940, and as late as November in 1936. A changing seasonal pattern, therefore, is required to describe this phenomenon. Sales data are now available for a sufficient number of years to make possible reasonably reliable estimates of the shifting seasonal movements.

Elimination of Trend and Cycle.

The first step in determining the effect of seasonal influences was to eliminate, as far as possible, the trend

[1] This revision was prepared by Louis J. Paradiso with the assistance of Robt L. Osborne and George Perkel. The April 1934 issue of the Survey of Current Business presents a detailed description of the original series and the methods employed in converting the raw data to an index of average daily sales on a value basis.

[2] The price factor developed by the Bureau of Foreign and Domestic Commerce represents the average price of new passenger automobiles for a specified month. It is not a conventional type of price with constant weights showing the price changes of a constant specification of materials, quality, etc., but rather the average amount the consumer pays in dollars for the units sold during a particular month.

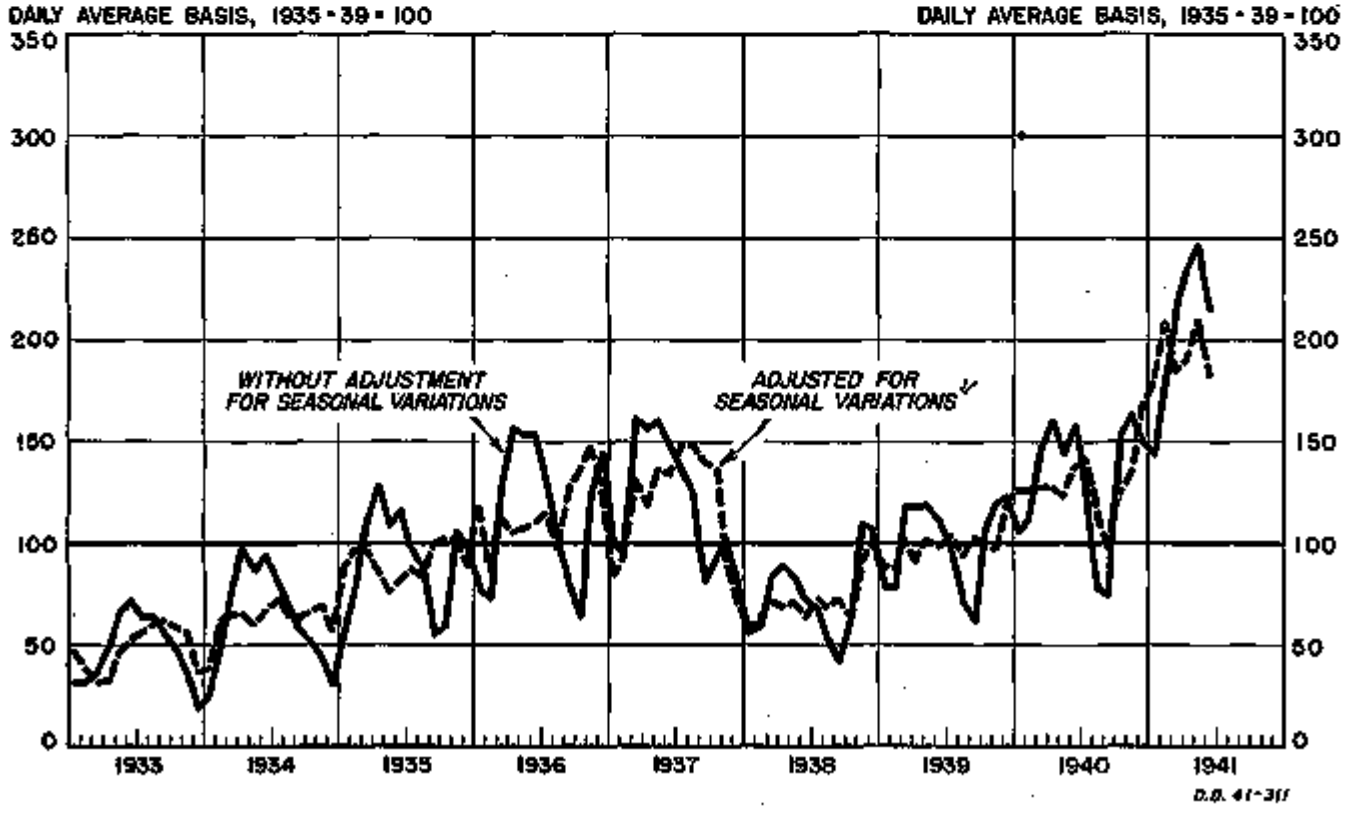

Figure 10.—Indexes of Dollar Sales of New Passenger Automobiles, 1933–41 (U. S. Department of Commerce).
The index is also adjusted for the effect of the change in the introduction date of new models.

and cyclical factors. This was done as follows: (1) 12-month moving averages were computed from the unadjusted monthly indexes for the period 1928–41; (2) to eliminate seasonal and random fluctuations more adequately, these averages were modified by the use of a more flexible free hand curve; (3) ratios of the monthly index figures to the modified moving averages were then computed; (4) these ratios to moving averages were plotted chronologically for each of the twelve months for the years, 1928–40.

Seasonal Adjustment Factors, 1928–34.

For the period prior to 1935, the seasonally adjusted factors were computed by well-established procedures. No well-defined trend appeared for any of the months, and after eliminating extreme observations, arithmetic averages of the ratios for the seven years were computed. The adjustment factors thus derived reflect the combined effect of purely seasonal factors, such as weather, and the effect of the new model introduction date which was rather constant prior to 1935.

Table 1.—1940 Adjustment Factors

Month	Usual seasonal adjustment factor based on 1928–34 period	Adjustment due to 1940 new model introduction date	Final 1940 seasonal adjustment factors
January	66	+18	84
February	83	+6	89
March	116	0	116
April	150	−24	126
May	143	−26	117
June	138	−23	115
July	113	−21	92
August	106	−37	69
September	90	−14	76
October	79	+45	124
November	63	+58	121
December	53	+36	89

Adjustment for Variable New Model Introduction Dates, 1935–41.

For each month of the period since 1935, the seasonal adjustment factors obtained for the 1928–34 period were first subtracted from the ratios to modified moving averages. The residuals of this subtraction process, although they include some purely random fluctuations, largely reflect the influence of the variable dates of new model introduction. In order to estimate the difference in sales due to introducing models in the autumn instead of in January, these residuals were then related to the date of new model introduction.

For this purpose a weighted average introduction date was computed from the dates of introduction reported by the various producers, the weights being the sales of the respective makes in the calendar year following the date of their introduction. The 15th of each month was used in measuring the interval in time between the month and average date of introduction. The number of days between the 15th of each month and the introduction date was then computed for six months preceding and six months following this date in each year. For those months preceding the introduction date the measurements were designated as minus and for the months following that date as plus.

Next, the residuals for each month were plotted (as shown in fig. 11) against the number of days before or after the date of new model introduction.[1] As was expected, in the months immediately preceding the introduction date the residuals were negative, since buyers are inclined to wait for new models, whereas in the months immediately following the introduction date, the residuals were positive. The average relationship

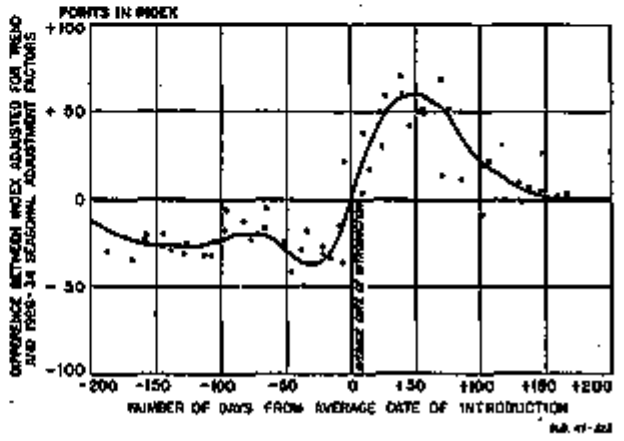

Figure 11.—Correction for the Effect of the Change in the Average Introduction Date of New Models of Passenger Automobiles, 1935–41 (U. S. Department of Commerce).

between the residuals and the number of days from introduction date was obtained by drawing a freehand smooth curve through these points on the chart. This curve has a zero value at the average date of introduction, negative values for the months preceding the date of introduction, and positive values for the months following. Thus, after allowing for the usual seasonal variations (as determined from the period prior to 1935), sales are below average for the six months preceding the introduction date and above average for the six months following. The lowest value on the curve occurs about a month before the date of introduction while the peak is reached about two months after, when the greatest effect of the new model stimulus is noted. Following the peak, the values rapidly diminish to zero.

The adjustment to allow for the effect of the changing date of new model introduction for each month was read from this curve.

Seasonal Adjustment Factors, 1935–41.

The final step in computing the seasonal adjustment factors was simply to add the correction due to new model introduction to the usual seasonal adjustment factor obtained from the 1928–34 period. For example, September 21 was computed to be the average date of new model introduction in 1940 and therefore, represented zero on the chart. To get the adjustment for October 1940, 24 units (the difference in days between

[1] The vertical scale was used for the residuals.

Table 2.—Indexes of Dollar Sales of New Passenger Automobiles, 1933–41

[Daily average basis, 1935–39=100]

Month	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941
Without Adjustment for Seasonal Variations														
January	79	109	82	53	35	31	25	57	77	100	50	78	104	142
February	96	135	104	67	41	33	50	80	72	95	50	78	111	178
March	135	189	138	89	45	36	75	110	130	162	84	117	147	218
April	182	251	170	124	61	50	97	126	157	167	89	117	159	238
May	165	230	150	105	58	50	86	106	153	100	63	116	144	240
June	107	100	139	90	62	72	93	116	154	149	72	111	165	*216
July	156	209	161	79	54	63	81	98	150	136	68	97	130	.....
August	102	150	97	65	38	54	69	88	103	125	54	70	78	.....
September	137	197	87	58	34	56	67	55	79	91	41	62	74	.....
October	130	146	69	43	25	47	52	69	63	91	51	106	134	.....
November	108	94	49	34	20	30	43	100	126	101	100	119	103	.....
December	76	69	52	38	22	19	30	80	144	78	105	122	150	.....
Annual index	134	163	104	70	40	48	63	92	110	126	73	100	131	.....
Adjusted for Seasonal Variations [1]														
January	120	105	124	80	53	47	38	85	117	85	57	68	125	178
February	114	151	125	81	40	37	60	96	87	91	48	87	125	200
March	116	163	118	77	37	31	65	95	112	131	71	101	127	188
April	121	167	113	83	41	33	65	85	105	113	60	91	127	160
May	129	188	109	73	41	45	60	70	107	130	70	101	123	209
June	121	142	94	65	45	52	67	84	112	134	64	99	137	*182
July	138	185	80	70	30	56	72	87	116	149	73	104	141	.....
August	103	173	92	61	35	50	65	83	97	140	68	93	113	.....
September	122	174	97	59	33	52	63	100	127	140	72	102	97	.....
October	172	154	87	54	32	60	66	102	137	135	62	90	134	.....
November	150	140	76	54	32	57	63	101	147	91	90	97	135	.....
December	142	128	85	72	42	36	57	88	130	70	100	121	160	.....

* Preliminary.
[1] Adjusted for seasonal changes and for the effect of the shifting date of new model introduction.

October 15 and September 21) were counted to the right of the origin, and the ordinate of the curve at this point was read as +45. This figure represents the amount of correction to be added to the usual seasonal adjustment factor already found for October, in order to adjust sales made in that month for the effect of the new model introduction date. Table 1 shows the adjustment factors obtained for the months of 1940 by the methods described above.

Table 2 presents the index figures from January 1928 to date, both before and after adjustment for the usual seasonal changes and for the effect of changing date of model introduction. The chart shows these indexes since 1933.

REVISED SERIES

Table 22.—ESTIMATES OF NONAGRICULTURAL EMPLOYMENT [1]

[Thousands of persons]

Item	January	February	March	April	May	June	July	August	September	October	November	December	Monthly average
1937													
Civil nonagricultural employment, total	34,429	34,730	35,250	35,559	35,380	35,979	36,076	36,240	36,402	36,101	35,384	34,727	35,561
Employees in nonagricultural establishments, total	28,348	28,654	29,146	29,484	29,767	29,861	29,851	30,078	30,259	30,022	28,172	28,604	29,142
Manufacturing	9,852	10,142	10,269	10,470	10,504	10,422	10,407	10,523	10,594	10,441	8,957	9,434	10,273
1938													
Civil nonagricultural employment, total	33,196	33,083	33,406	33,228	32,945	32,881	32,883	33,253	33,523	33,911	33,866	34,180	33,362
Employees in nonagricultural establishments, total	27,073	26,961	26,977	27,002	26,909	26,749	26,751	27,117	27,079	27,720	27,719	28,049	27,229
Manufacturing	8,888	8,931	8,809	8,710	8,520	8,370	8,411	8,746	9,014	9,003	9,149	9,220	8,827
1939													
Civil nonagricultural employment, total	33,369	33,495	33,748	33,817	34,113	34,500	34,484	34,882	34,630	35,832	35,701	35,929	34,624
Employees in nonagricultural establishments, total	27,100	27,316	27,606	27,674	27,970	28,447	28,451	28,738	28,507	29,680	29,668	29,785	28,480
Manufacturing	9,070	9,219	9,207	9,260	9,212	9,269	9,270	9,515	9,567	10,152	10,100	10,185	9,544
1940													
Civil nonagricultural employment, total	34,751	34,880	34,852	34,882	35,163	35,425	35,464	35,902	35,828	36,857	36,960	37,608	35,758
Employees in nonagricultural establishments, total	28,609	28,813	28,709	28,730	29,020	29,252	29,311	29,759	29,585	30,724	30,843	31,465	29,613
Manufacturing	9,974	9,974	9,920	9,832	9,779	9,824	9,892	10,103	10,079	10,908	10,735	10,866	10,179

[1] Revised series, compiled by the *U. S. Dept. of Labor, Bureau of Labor Statistics*. Estimates of employment in manufacturing establishments have been revised beginning January 1937 to adjust data to preliminary employment figures from the 1939 Census of Manufactures; estimates for total employment in nonagricultural establishments and total civil nonagricultural employment have been adjusted to take account of this revision. For earlier data and a description of the series, see table 11, p. 17 of the March 1941 Survey; for data for 1941, see p. 8-7 of this issue.